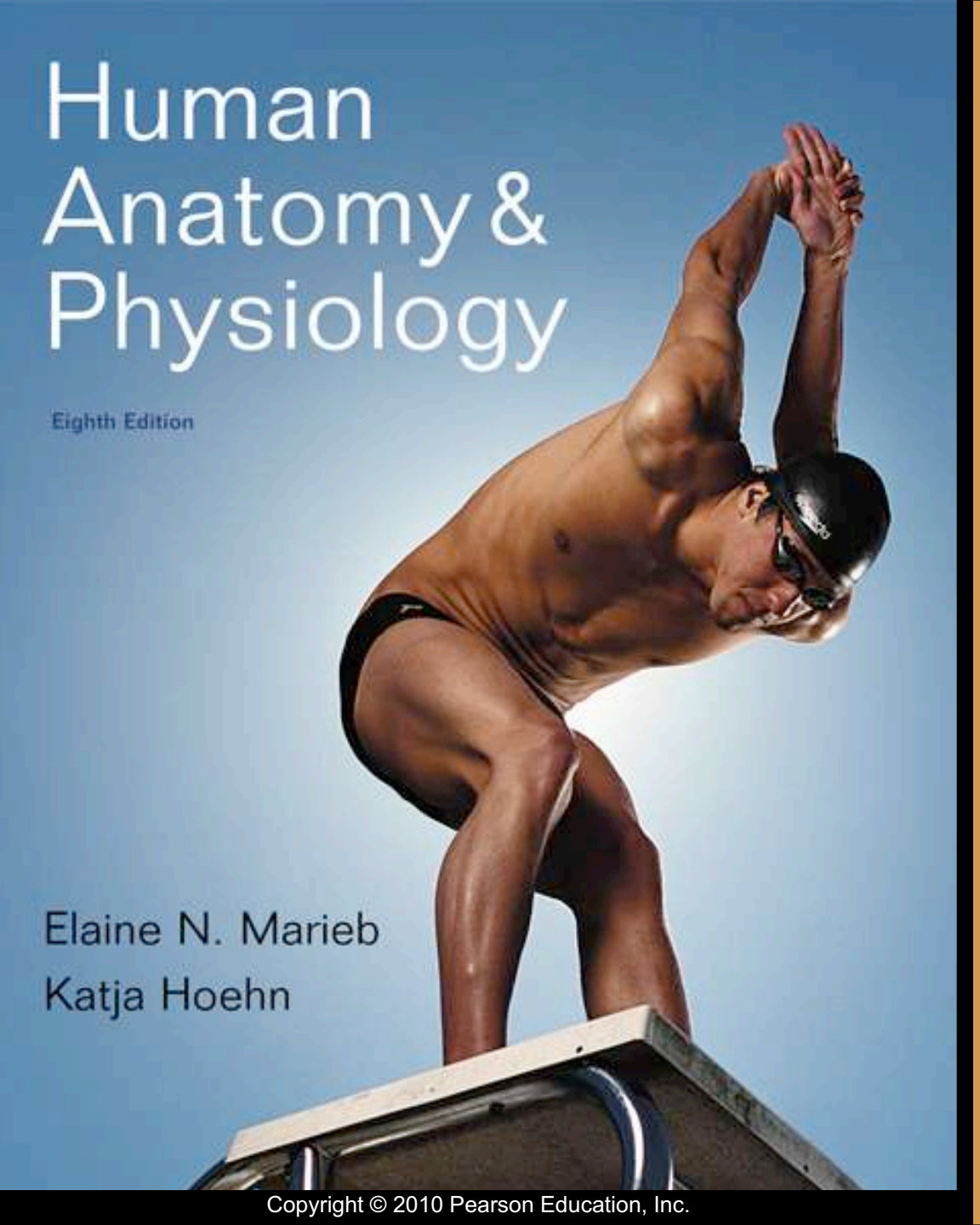

PowerPoint® Lecture Slides
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CHAPTER 6

Bones and Skeletal Tissues: Part A

Skeletal Cartilages

- Contain no blood vessels or nerves
- Dense connective tissue girdle of perichondrium contains blood vessels for nutrient delivery to cartilage
- Slow recovery

Skeletal Cartilages

1. Hyaline cartilages (articular)
   - Provide support, flexibility, and resilience
   - Most abundant type
   - Trachea, joints, nose, & ribs
2. Elastic cartilages
   - Similar to hyaline cartilages, but contain elastic fibers
   - Ear
3. Fibrocartilages
   - Collagen fibers—have great tensile strength
   - Vertebra

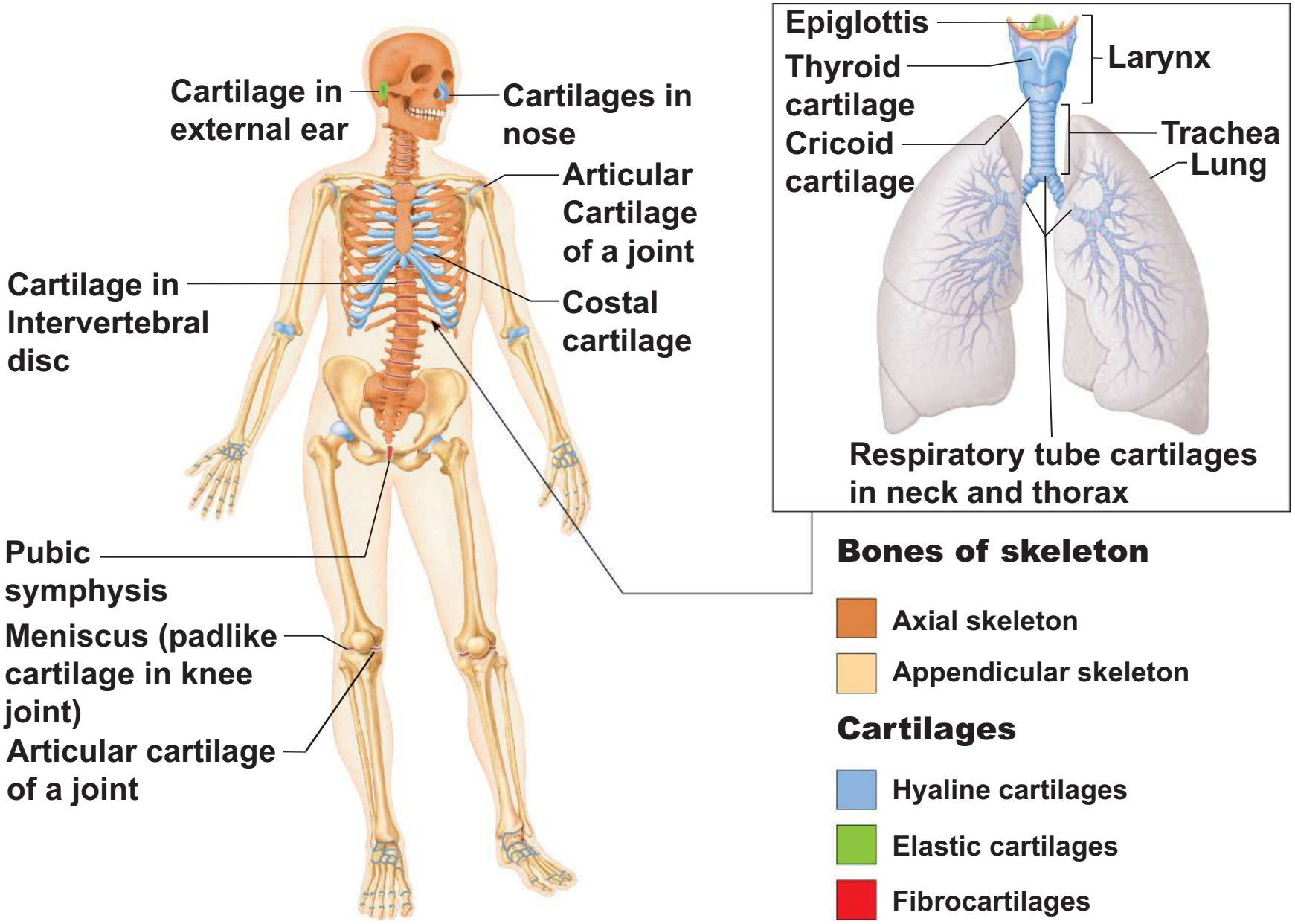


Figure 6.1

Growth of Cartilage

- Appositional
  - Cells secrete matrix against the external face of existing cartilage (along the outside surface)
- Interstitial
  - Chondrocytes divide and secrete new matrix, expanding cartilage from within
- Calcification of cartilage occurs during
  - Normal bone growth
  - Old age
  - Calcified cartilage is not bone

Bones of the Skeleton

- Two main groups, by location
  - Axial skeleton
    Head, vertebra, & ribs
  - Appendicular skeleton
    Limbs, shoulders, & hips

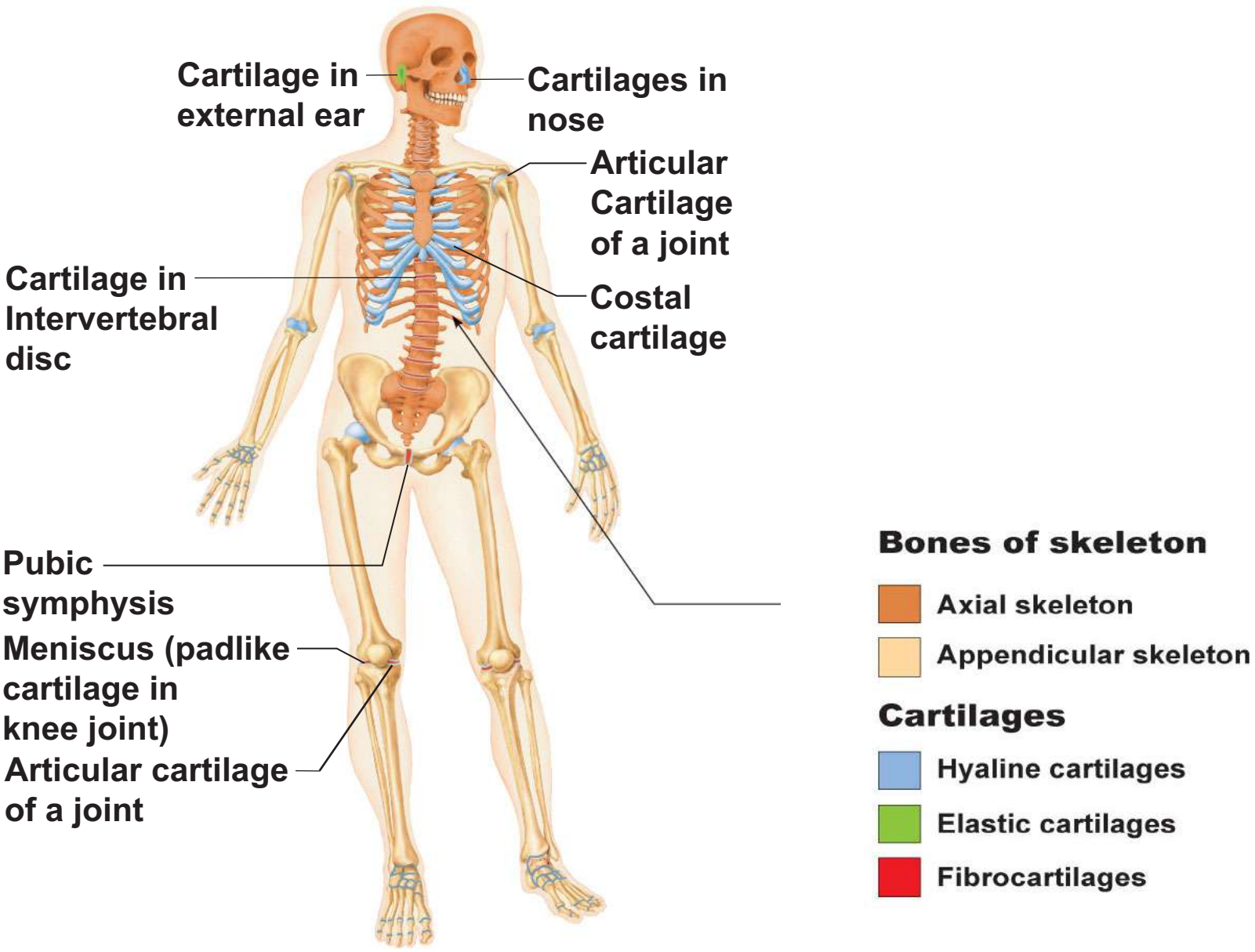


Figure 6.1

Classification of Bones by Shape

- Long bones
  - Longer than they are wide
- Short bones
  - Cube-shaped bones (in wrist and ankle)
  - Sesamoid bones (within tendons, e.g., patella)

Classification of Bones by Shape

- Flat bones
  - Thin, flat, slightly curved
- Irregular bones
  - Complicated shapes

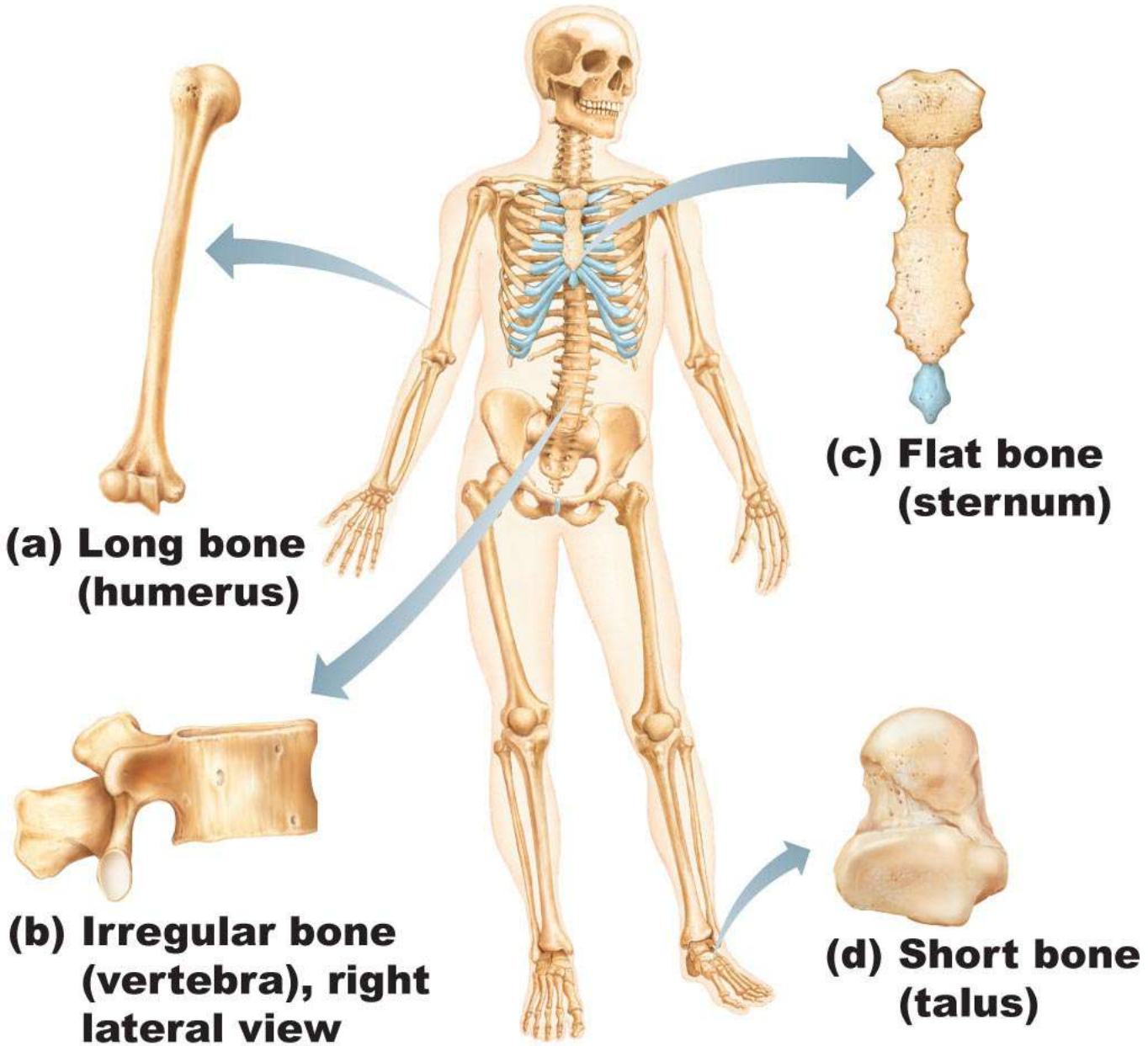


Figure 6.2

Functions of Bones

- Support
  - For the body and soft organs
- Protection
  - For brain, spinal cord, and vital organs
- Movement
  - Levers for muscle action

Functions of Bones

- Storage
  - Minerals (calcium and phosphorus) and growth factors
- Blood cell formation (hematopoiesis) in marrow cavities
- Triglyceride (energy) storage in bone cavities

Bone Markings

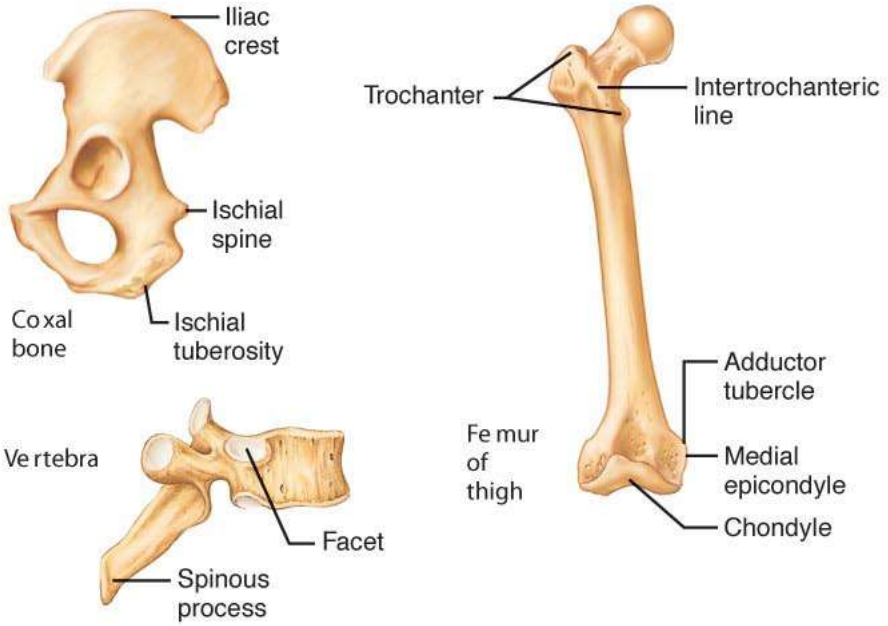
- Bulges, depressions, and holes serve as
  - Sites of attachment for muscles, ligaments, and tendons
  - Joint surfaces
  - Conduits for blood vessels and nerves

Bone Markings: Projections

- Sites of muscle and ligament attachment
  - Tuberosity—rounded projection
  - Crest—narrow, prominent ridge
  - Trochanter—large, blunt, irregular surface
  - Line—narrow ridge of bone
  - Tubercle—small rounded projection
  - Epicondyle—raised area above a condyle
  - Spine—sharp, slender projection
  - Process—any bony prominence

TABLE 6.1 Bone Markings

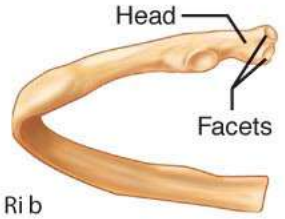
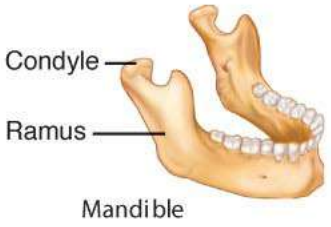
NAME OF BONE MARKING	DESCRIPTION	ILLUSTRATIONS
Projections That Are Sites of Muscle and Ligament Attachment		
Tuberosity (too″bĕ-ros′ĭ-te)	Large rounded projection; may be roughened	
Crest	Narrow ridge of bone; usually prominent	
Trochanter (tro-kan′ter)	Very large, blunt, irregularly shaped process (the only examples are on the femur)	
Line	Narrow ridge of bone; less prominent than a crest	
Tubercle (too′ber-kl)	Small rounded projection or process	
Epicondyle (ep″ĭ-kon′dīl)	Raised area on or above a condyle	
Spine	Sharp, slender, often pointed projection	
Process	Any bony prominence	



Bone Markings: Projections

- Projections that help to form joints
  - Head
    - Bony expansion carried on a narrow neck
  - Facet
    - Smooth, nearly flat articular surface
  - Condyle
    - Rounded articular projection
  - Ramus
    - Armlike bar

TABLE 6.1 Bone Markings

NAME OF BONE MARKING	DESCRIPTION	ILLUSTRATIONS
Projections That Help to Form Joints		
Head	Bony expansion carried on a narrow neck	
Facet	Smooth, nearly flat articular surface	
Condyle (kon′dil)	Rounded articular projection	
Ramus (ra′mus)	Armlike bar of bone	

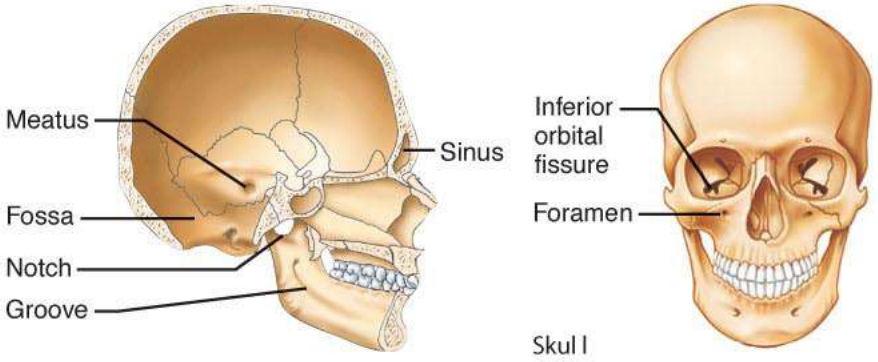
Bone Markings: Depressions and Openings

- Meatus
  - Canal-like passageway
- Sinus
  - Cavity within a bone
- Fossa
  - Shallow, basinlike depression
- Groove
  - Furrow
- Fissure
  - Narrow, slitlike opening
- Foramen
  - Round or oval opening through a bone

TABLE 6.1 Bone Markings

NAME OF BONE MARKING	DESCRIPTION
Depressions and Openings	
For Passage of Blood Vessels and Nerves	
Groove	Furrow
Fissure	Narrow, slitlike opening
Foramen (fo-ra′men)	Round or oval opening through a bone
Notch	Indentation at the edge of a structure
Others	
Meatus (me-a′tus)	Canal-like passageway
Sinus	Cavity within a bone, filled with air and lined with mucous membrane
Fossa (fos′ah)	Shallow, basinlike depression in a bone, often serving as an articular surface

ILLUSTRATIONS



Bone Textures

- Compact bone
  - Dense outer layer
  - Shaft of long bones (diaphysis)
- Spongy (cancellous) bone
  - Honeycomb of trabeculae
  - Vertebra, ribs, head of long bones

Structure of a Long Bone

- Diaphysis (shaft)
  - Compact bone collar surrounds medullary (marrow) cavity
  - Medullary cavity in adults contains fat (yellow marrow)

Structure of a Long Bone

- Epiphyses
  - Expanded ends
  - Spongy bone interior
  - Epiphyseal line (remnant of growth plate)
  - Articular cartilage (hyaline) on joint surfaces

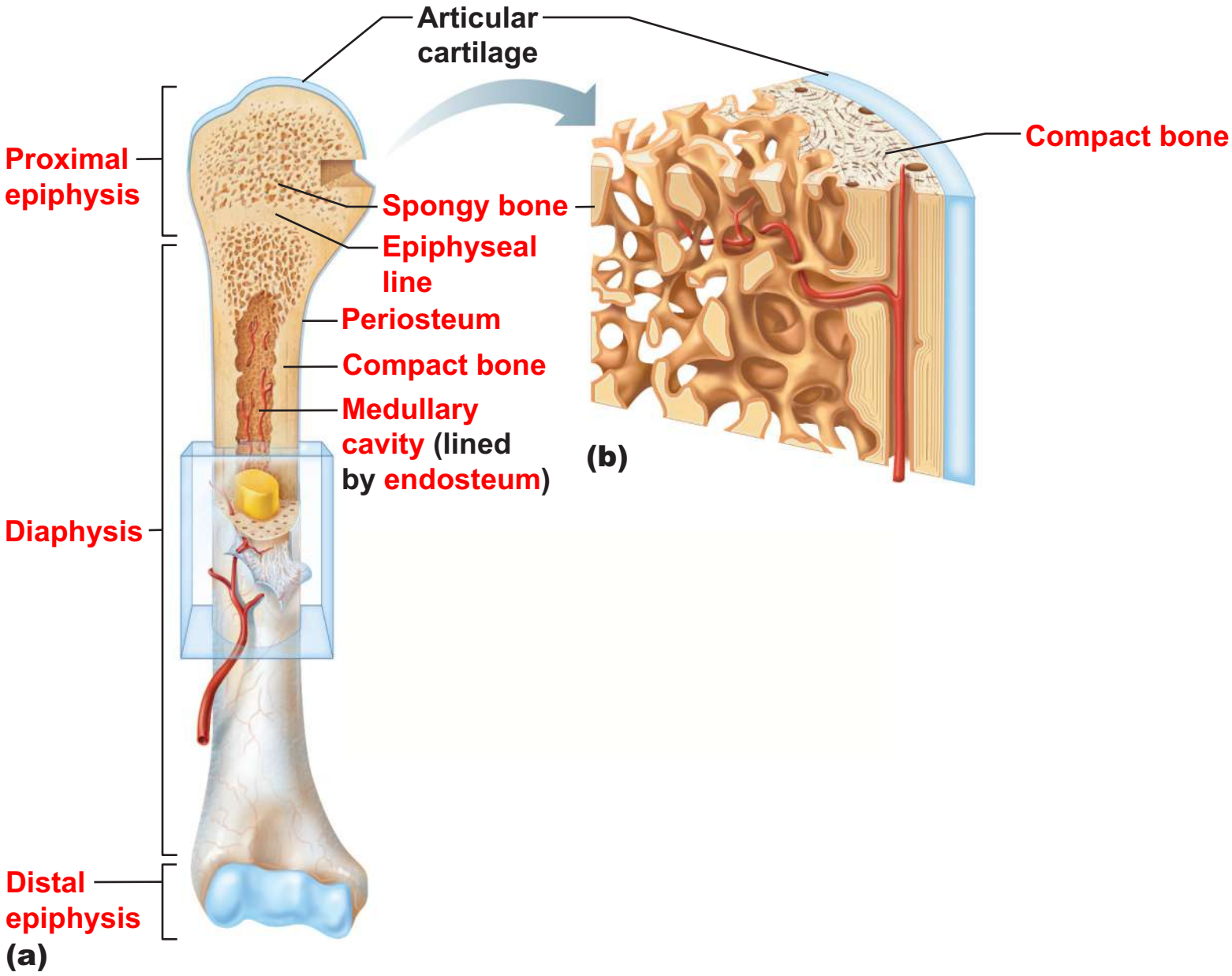


Figure 6.3a-b

Membranes of Bone

- Periosteum
  - Outer fibrous layer (dense irregular fibrous connective tissue)
  - Inner osteogenic layer
    - Osteoblasts (bone-forming cells)
    - Osteoclasts (bone-destroying cells)
    - Osteogenic cells (stem cells)
  - Nerve fibers, nutrient blood vessels, and lymphatic vessels enter the bone via nutrient foramina
  - Secured to underlying anchoring points bone by Sharpey's fibers

Membranes of Bone

- Endosteum
  - Delicate membrane on **all** internal surfaces of bone
  - Also contains osteoblasts and osteoclasts

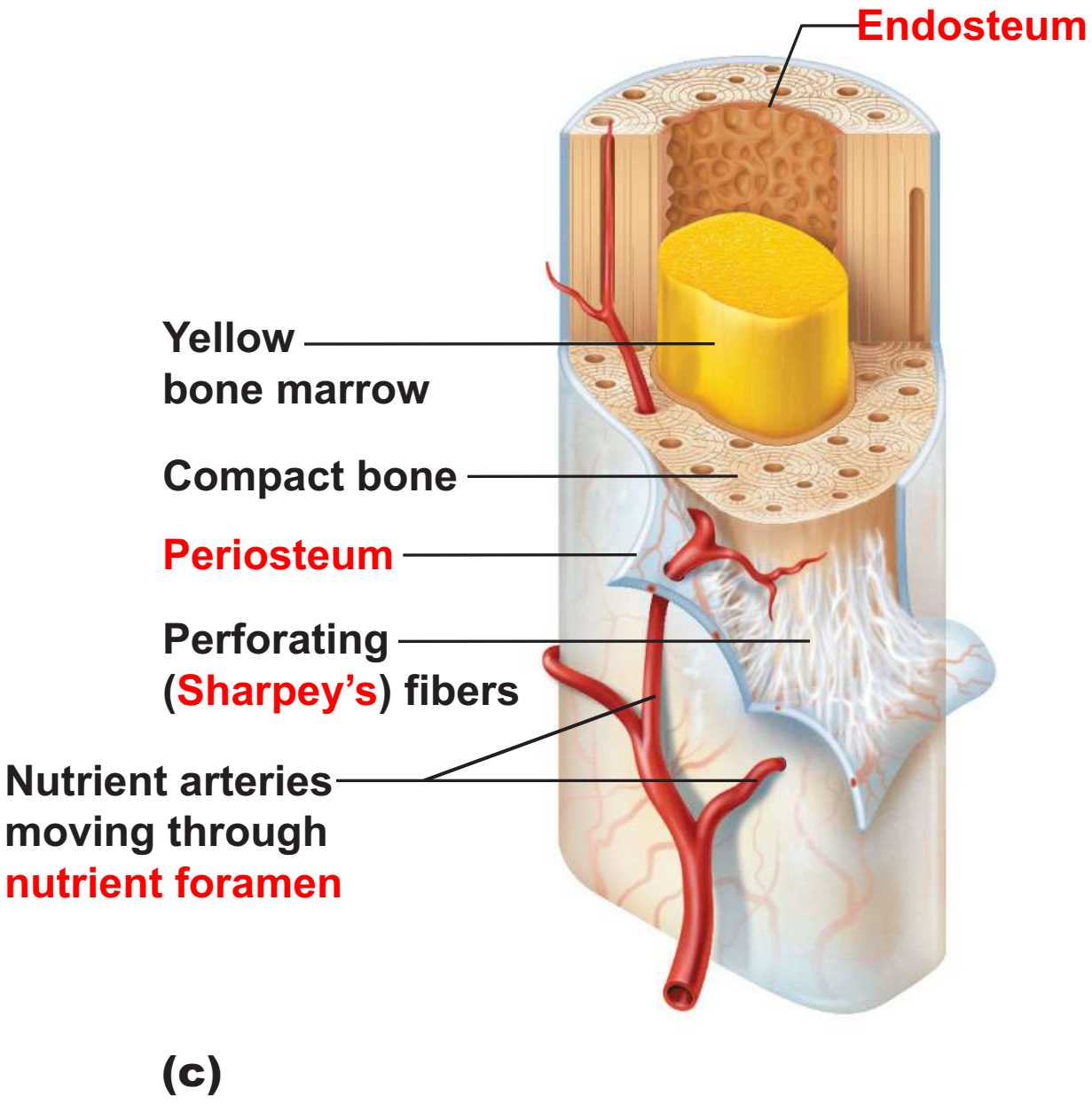


Figure 6.3c

Structure of Short, Irregular, and Flat Bones Spongey Bone

- Periosteum-covered compact bone on the outside
- Endosteum-covered spongy bone within
- Spongy bone called diploë in flat bones
- Red bone marrow in cavities between the trabeculae

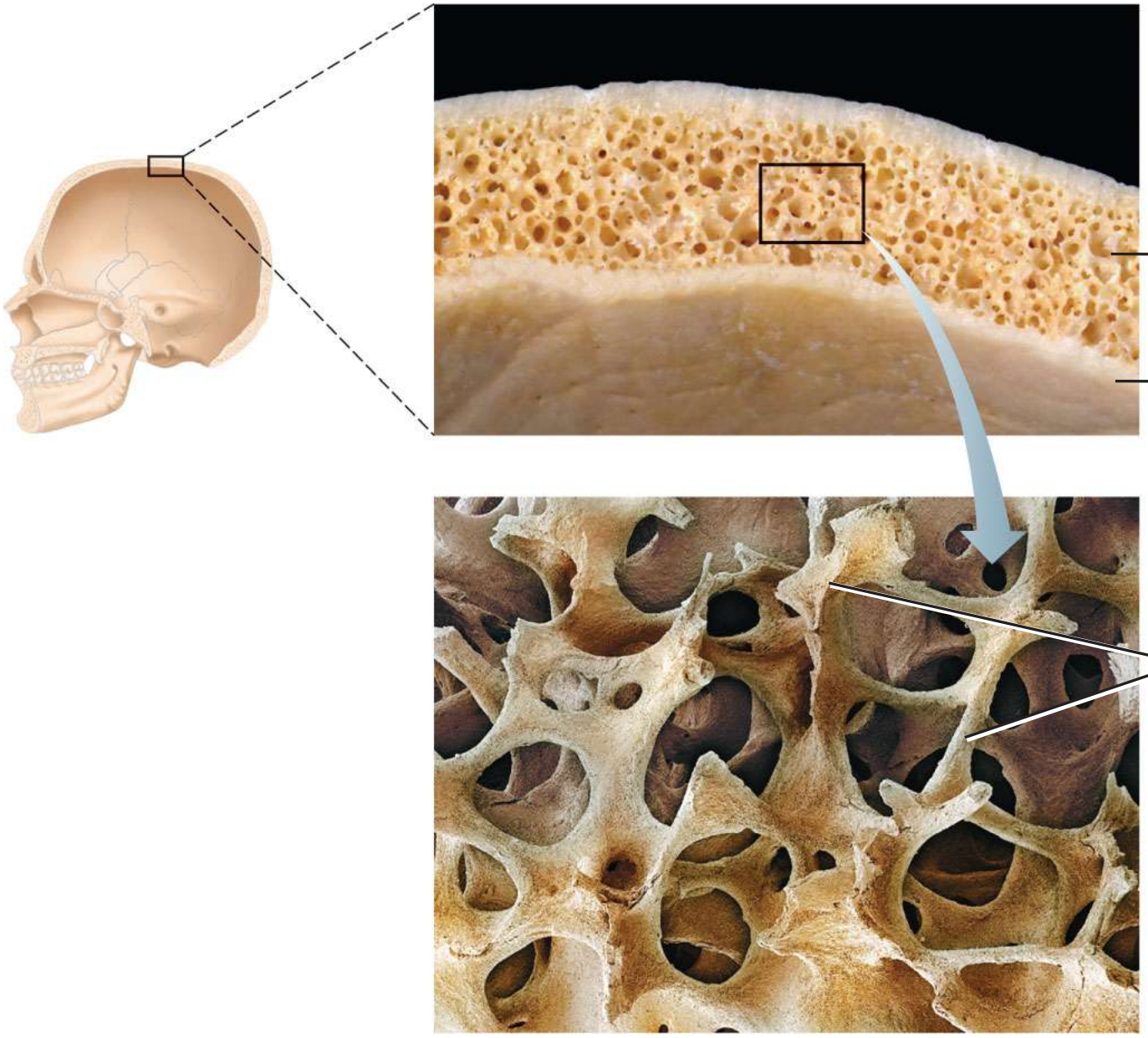


Figure 6.5

Location of Hematopoietic Tissue (Red Marrow)

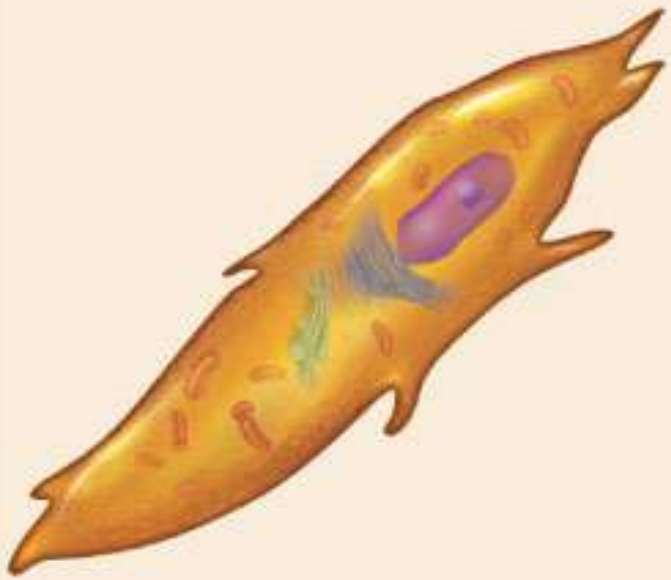
- Red marrow cavities of adults
  - Trabecular cavities of the heads of the femur and humerus
  - Trabecular cavities of the diploë of flat bones
- Red marrow of newborn infants
  - Medullary cavities and all spaces in spongy bone

Microscopic Anatomy of Bone

- Cells of bones
  - Osteogenic (osteoprogenitor) cells
    - Stem cells in periosteum and endosteum that give rise to osteoblasts
  - Osteoblasts
    - Bone-forming cells

(a) Osteogenic cell

Stem cell



(b) Osteoblast

Matrix-synthesizing cell responsible for bone growth

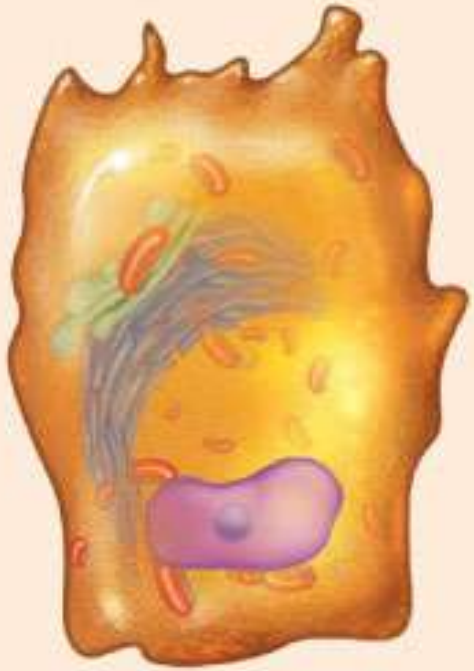


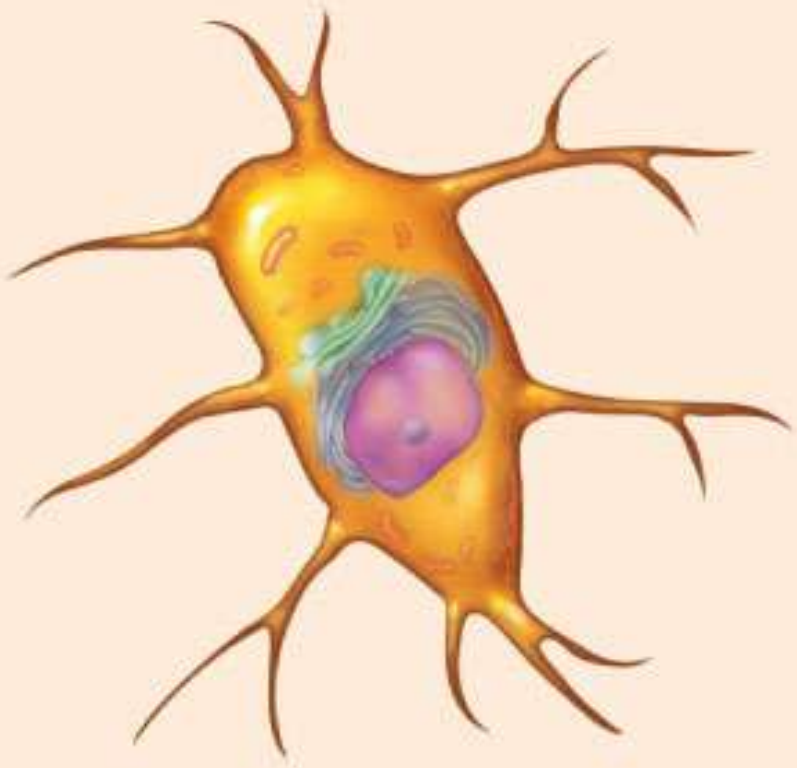
Figure 6.4a-b

Microscopic Anatomy of Bone

- Cells of bone
  - Osteocytes
    - Mature bone cells
  - Osteoclasts
    - Cells that break down, clean up, & resorb old or damaged bone matrix

(c) Osteocyte

Mature bone cell that maintains the bone matrix



(d) Osteoclast

Bone-resorbing cell

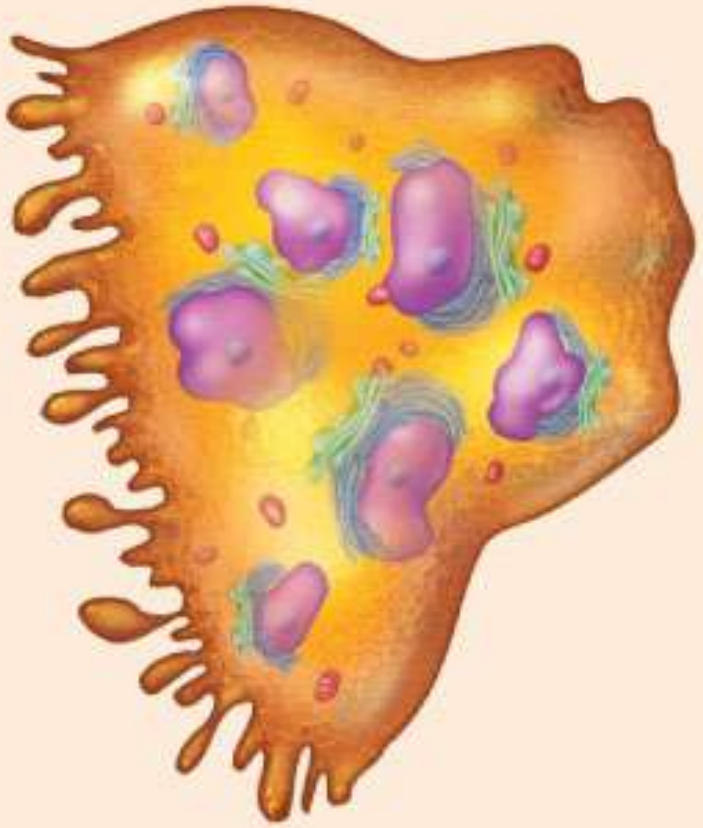


Figure 6.4c-d

Microscopic Anatomy of Bone: Compact Bone

- Haversian system, or osteon—structural unit
  - Lamellae
    - Weight-bearing
    - Column-like matrix tubes
    - Concentric rings of bone matrix
  - Central Haversian canal
    - Contains blood vessels and nerves

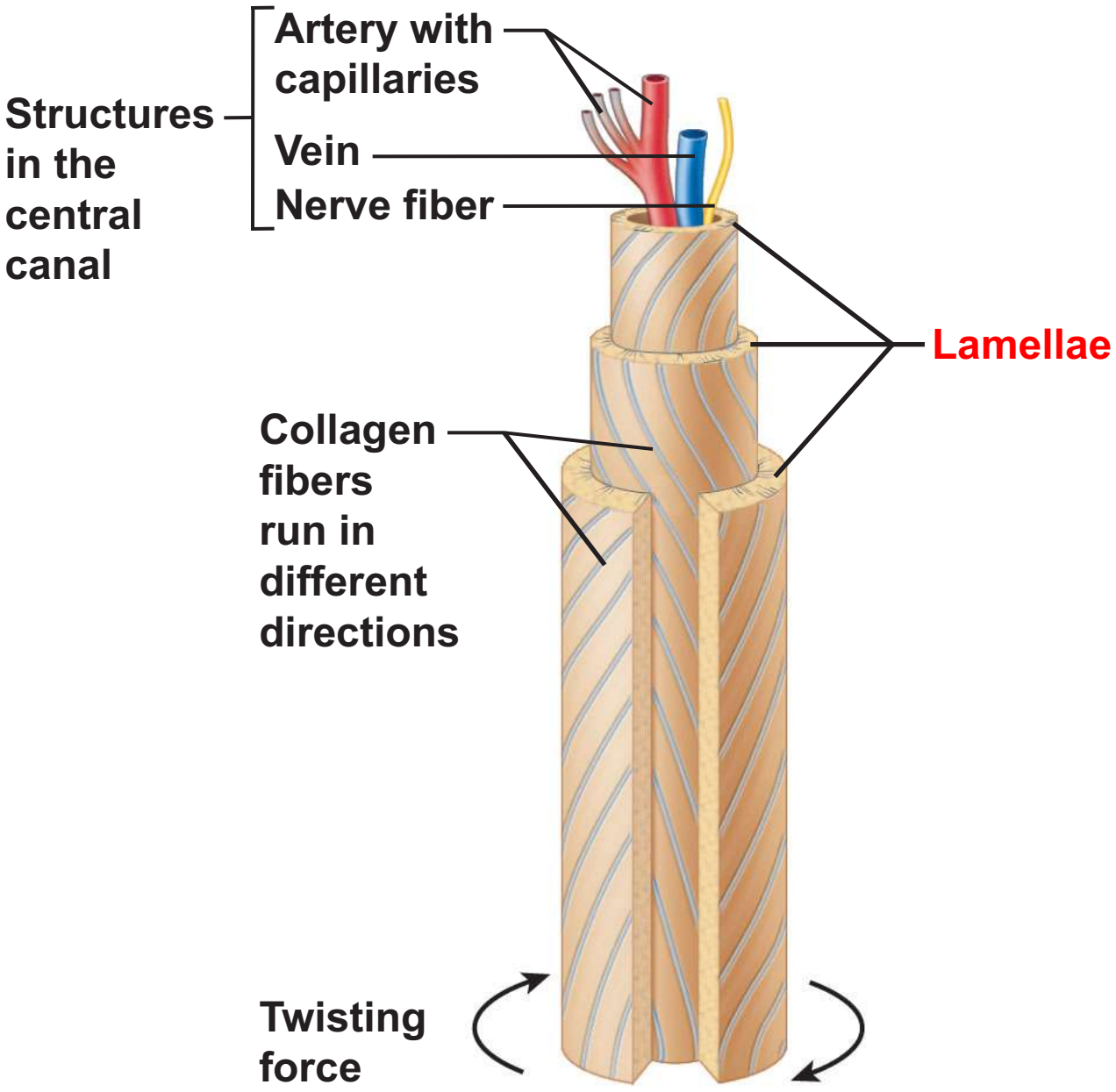


Figure 6.6

Microscopic Anatomy of Bone: Compact Bone

- Perforating Volkmann's canals
  - At right angles to the central canal
  - Connects blood vessels and nerves of the periosteum and central canal (osteon to osteon)
- Lacunae—small cavities that contain osteocytes
- Canaliculi—hairlike canals that connect lacunae to each other and the central canal and lamellae of osteon to each other

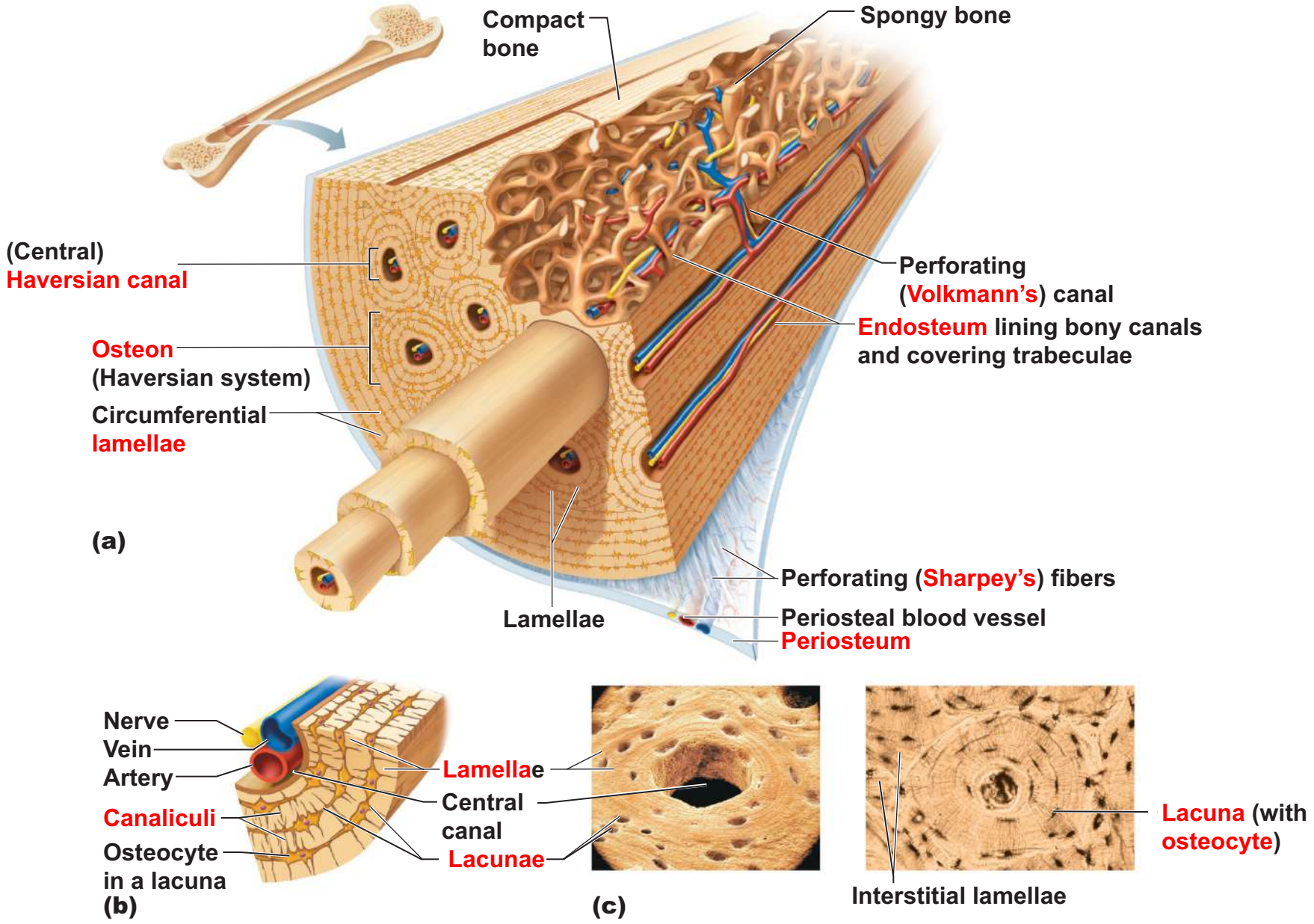


Figure 6.7a-c

Microscopic Anatomy of Bone: Spongy Bone

- Trabeculae
  - Align along lines of stress
  - No osteons
  - Contain irregularly arranged lamellae, osteocytes, and canaliculi
  - Capillaries in endosteum supply nutrients

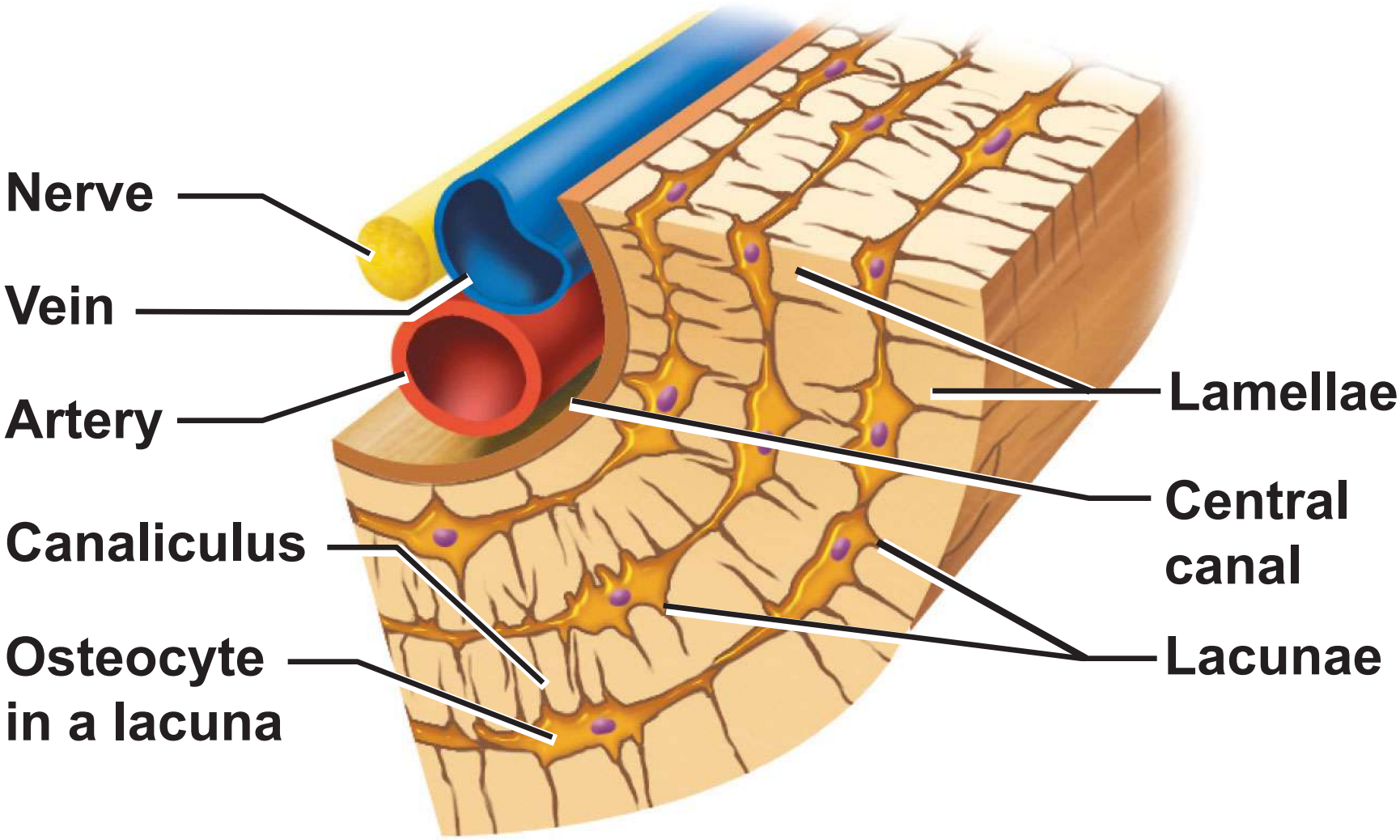


Figure 6.3b

Chemical Composition of Bone: Organic

- Osteogenic cells, osteoblasts, osteocytes, osteoclasts
- Osteoid—organic bone matrix secreted by osteoblasts
  - Ground substance (proteoglycans, glycoproteins)
  - Collagen fibers
    - Provide tensile strength and flexibility

Chemical Composition of Bone: Inorganic

- Hydroxyapatites (mineral salts)
  - 65% of bone by mass
  - Mainly calcium phosphate crystals
  - Responsible for hardness and resistance to compression